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Meridian Circle Observation of Comparison Stars.

The three stars which I used for comparison with Comet *b*, 1893, on the nights of July 11, 12 and 13, have been observed with the meridian circle for definite place:

L. O. No.	A. R. 1894.0	Decl. 1894.0	W. B.
	H. M. S.	° ′ ″	
090646	9 6 22.73	+ 44 44 45.3	56
093751	9 37 27.77	+ 42 32 16.9	749
095954	9 59 32.98	+ 40 5 50.2	1204

The mean epoch of observation is 1894.22. The second star differs — 4″ in Declination from Bessel's place.

Following are the precessions for 1894:

	s	″
090646	+ 3.967	— 14.57
093751	+ 3.787	— 16.30
095954	+ 3.637	— 17.35

R. H. T.

The Lick Observatory Photographs of *Mars*.

It is well known that the border of the disc of *Mars* is considerably brighter than the interior of the disc. Just how much of the observed effect is real and how much is due to contrast with the dark-sky background has been uncertain. The eye likewise is unable to distinguish between small differences of brightness, and it has been supposed that the limb of the planet is about equally brightened at all points of it. The prominent markings on the surface can occasionally be followed nearly to the limb, but they are generally lost to view at some distance from it.

A recent examination of the Lick photographs of *Mars*, taken by Professor Holden in 1890 and 1892, shows that they are extremely valuable in deciding the questions of relative brightness referred to above. The photographs record photographic intensities of light in their true order, and are not affected by brighter or fainter surrounding areas, as must always be the case with eye estimates.

Three series of photographs were taken: with the plate in the focus of the large objective, which gave very small images; with an intermediate amplifying lens magnifying about 5 diameters; and with an amplifying lens magnifying about 8 diameters.

When *Mars* is *at* or *very near* opposition the photographs show that the border of the planet is very much brighter than the interior areas. But the brightness is far from uniform. When certain dark markings are on the edge of the disc, the limb at those points is only slightly brightened. When certain bright markings are on the edge of the disc, those parts of the limb are almost as bright as the polar caps. The brightness of the periphery is very irregular, and varies as different portions of the planet come to the limb.

When *Mars* is a few weeks from opposition the *limb* is irregularly brightened, just as described above, and the terminator is similarly brightened, but to a less extent.

When *Mars* is at a considerable distance from opposition, so that the terminator shows plainly, and the planet is gibbous, the *limb* is brightened as before, but the *terminator* is not perceptibly brightened. The terminator is very irregular in outline and is nearer the center of the disc than its theoretical position, just as in the case of Moon photographs.

The photographs show the most prominent surface features of the planet very clearly.

It has been suggested that the increased brightness of the limb of *Mars* is produced by the planet's *atmosphere*. It seems to me that the irregularities and variations in the brightness of the limb render that view untenable. If the effect were wholly atmospheric we would expect the limb to be uniformly brightened.

Several astronomers have suggested that the increased brightness is due to morning and evening clouds. If that were true, the *limb* should not be brightened perceptibly when the angle at *Mars* between the Sun and Earth is large. Some of our photographs were made when that angle was 37°.5, on May 31, 1892. We would expect the morning clouds to be completely hidden from us by the planet at that time. Yet the photographs show no perceptible diminution in the usual brightness of the limb. The very low albedo of the planet is also an objection to the cloud theory.

The photographs show pretty conclusively that *the brightened border is caused by surface features of the planet, the brightest regions giving the brightest borders.* The same effect is well known in the case of the Moon; the limb is brighter than the interior because the mountain structures reflect more light than the level areas; at the *limb* the mountains form the entire visible reflecting background, the level plains and valleys not forming any part of it. I think we must look for a similar explanation in the case of *Mars;* though, as others have pointed out, other things being equal, very steep mountain slopes would be required.

The importance of making a series of short-exposure photographs in connection with other observations of the planet is very evident.

W. W. C.

THE LEVELS OF THE MERIDIAN CIRCLE.

A progressive change has been taking place in the level of the instrument, marked by exceptional uniformity with but little variation from day to day.

It seemed at first possible to connect the change with that of temperature, as the level correction decreased with the approach of cold weather. But whatever small part of the change follows from this cause is evidently masked by the regular movement. The fluctuations of temperature within periods of a few days have often been nearly up to the total range, while the level has shown no variation to correspond.

In tabulating the mean level by months, the temperature given is the mean of the thermometer readings at the times the levels were taken:

		b.	Temp.
1893.	September	+.663	54°.5
	October	+.648	55 .2
	November	+.623	50 .6
	December	+.561	48 .8
1894.	January	+.506	45 .3
	February	+.402	40 .3
	March	+.359	44 .3

The azimuth of the instrument shows no progressive change, the daily fluctuations being nearly as great as the whole variation.

R. H. T.

SCHIAPARELLI'S OBSERVATIONS OF BRIGHT SPOTS ON *MARS.*

On a previous page of this *Publication* I referred to SCHIAPARELLI'S observations of bright spots on the planet *Mars*. I have translated his account of them as follows, from *Himmel und Erde*, Vol. I, pages 14, 15, 16, 159, for the benefit of *Mars* observers.

W. W. C.